

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C. 20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

| | |
|---|---|
| Date of mailing (day/month/year) 02 May 2000 (02.05.00) | |
| International application No. PCT/EP99/05632 | Applicant's or agent's file reference GR 98P2423 |
| International filing date (day/month/year) 03 August 1999 (03.08.99) | Priority date (day/month/year) 28 August 1998 (28.08.98) |
| Applicant RADEMACHER, Leo | |

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
28 March 2000 (28.03.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

| | |
|---|---|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35 | Authorized officer C. Villet Telephone No.: (41-22) 338.83.38 |
|---|---|

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

To:

SIEMENS AKTIENGESELLSCHAFT
Postfach 22 16 34
D-80506 München
GERMANY

ZT GG VM Mch P/Ri

Eing.

17. Jan. 2000 WOM

GR
Erist

Date of mailing
(day/month/year)

12/01/2000

Applicant's or agent's file reference

GR 98P2423

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/EP 99/ 05632

International filing date
(day/month/year)

03/08/1999

Applicant

SIEMENS AKTIENGESELLSCHAFT et al.

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Fascimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Liliane Van Velzen-Peron

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| | | |
|--|---|--|
| Applicant's or agent's file reference GR 98P2423 | FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. | |
| International application No. PCT/EP 99/05632 | International filing date (day/month/year) 03/08/1999 | (Earliest) Priority Date (day/month/year) 28/08/1998 |
| Applicant SIEMENS AKTIENGESELLSCHAFT et al. | | |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

3

☐ None of the figures.

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H04B1/707

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------|
| X | EP 0 491 668 A (ERICSSON GE MOBILE COMMUNICAT) 24 June 1992 (1992-06-24) abstract column 2, line 52 -column 3, line 41 column 4, line 55 -column 5, line 15; figure 3 column 6, line 44 -column 7, line 9 column 7, line 51 -column 8, line 2; figure 7 column 8, line 57 -column 9, line 11; figure 8 column 9, line 27 - line 43 column 10, line 10 - line 49 column 12, line 28 - line 35 column 18, line 1 - line 12 --- -/-- | 1-19 |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

16 December 1999

Date of mailing of the international search report

12/01/2000

Name and mailing address of the ISA

 European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
 Fax: (+31-70) 340-3016

Authorized officer

Ó Donnabháin, E

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------------|--|--|
| X A A | WO 95 22209 A (PETERSEN BRENT ROBERT ;ELEFTHERIOU EVANGELOS (CH); IBM DEUTSCHLAND) 17 August 1995 (1995-08-17) page 5, line 17 -page 6, line 15 ----- US 5 490 165 A (WEAVER JR LINDSAY A ET AL) 6 February 1996 (1996-02-06) column 5, line 45 -column 6, line 56; figures 1,6 ----- | 1,2, 9-11,18, 19 3-8, 12-17 1,9 |
| | | |

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
|---|---|---------------------|----------------------------|---------------------|
| EP 0491668 | A | 24-06-1992 | US 5151919 A | 29-09-1992 |
| | | | AT 163336 T | 15-03-1998 |
| | | | AU 645646 B | 20-01-1994 |
| | | | AU 9136691 A | 22-07-1992 |
| | | | CA 2076006 A | 18-06-1992 |
| | | | DE 69128927 D | 26-03-1998 |
| | | | DE 69128927 T | 04-06-1998 |
| | | | ES 2113876 T | 16-05-1998 |
| | | | FI 923678 A | 17-08-1992 |
| | | | GR 3026244 T | 29-05-1998 |
| | | | HK 1009366 A | 28-05-1999 |
| | | | MX 9102562 A | 01-06-1992 |
| | | | SG 49656 A | 15-06-1998 |
| | | | WO 9211716 A | 09-07-1992 |
| | | | US 5218619 A | 08-06-1993 |
| WO 9522209 | A | 17-08-1995 | BR 9408527 A | 05-08-1997 |
| | | | DE 69412288 D | 10-09-1998 |
| | | | DE 69412288 T | 22-04-1999 |
| | | | EP 0744101 A | 27-11-1996 |
| | | | JP 9503113 T | 25-03-1997 |
| | | | US 5761237 A | 02-06-1998 |
| US 5490165 | A | 06-02-1996 | AU 685869 B | 29-01-1998 |
| | | | AU 8096394 A | 22-05-1995 |
| | | | BR 9405888 A | 26-12-1995 |
| | | | CA 2150932 A | 04-05-1995 |
| | | | EP 0676107 A | 11-10-1995 |
| | | | FI 953210 A | 28-08-1995 |
| | | | IL 111432 A | 10-03-1998 |
| | | | JP 2938573 B | 23-08-1999 |
| | | | JP 8508152 T | 27-08-1996 |
| | | | WO 9512262 A | 04-05-1995 |
| | | | ZA 9407841 A | 18-05-1995 |

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

SIEMENS AKTIENGESELLSCHAFT

Postfach 22 16 34
D-80506 München
ALLEMAGNE

ZT GG VM Mch P/Ri

Eing. 15. Dez. 2000

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Frist

28.12.00

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing
(day/month/year)

14.12.2000

Applicant's or agent's file reference

GR 98 P 2423 P

IMPORTANT NOTIFICATION

International application No.

PCT/EP99/05632

International filing date (day/month/year)

03/08/1999

Priority date (day/month/year)

28/08/1998

Applicant

SIEMENS AKTIENGESELLSCHAFT et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



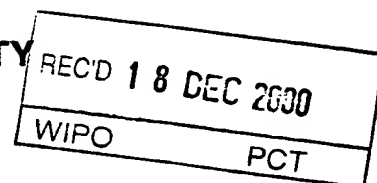
European Patent Office
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Authorized officer

Poquet Oliver, R

Tel. +49 89 2399-2911





INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

3

| | | |
|---|--|--|
| Applicant's or agent's file reference GR 98 P 2423 P | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/EP99/05632 | International filing date (day/month/year) 03/08/1999 | Priority date (day/month/year) 28/08/1998 |
| International Patent Classification (IPC) or national classification and IPC H04B1/707 | | |
| Applicant SIEMENS AKTIENGESELLSCHAFT et al. | | |

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 8 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☒ Certain observations on the international application

| | |
|---|---|
| Date of submission of the demand 28/03/2000 | Date of completion of this report 14.12.2000 |
| Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465 | Authorized officer Ciccarese, C Telephone No. +49 89 2399 7302  |

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP99/05632

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:

Description, pages:

| | | | |
|----------|---------------------|------------|---------------------------|
| 1,2,4-17 | as originally filed | | |
| 3,3a | as received on | 15/11/2000 | with letter of 14/11/2000 |

Claims, No.:

| | | | |
|------|----------------|------------|---------------------------|
| 1-18 | as received on | 15/11/2000 | with letter of 14/11/2000 |
|------|----------------|------------|---------------------------|

Drawings, sheets:

| | |
|---------|---------------------|
| 1/5-5/5 | as originally filed |
|---------|---------------------|

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP99/05632

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|------|--------|------|
| Novelty (N) | Yes: | Claims | 1-18 |
| | No: | Claims | |
| Inventive step (IS) | Yes: | Claims | 1-18 |
| | No: | Claims | |
| Industrial applicability (IA) | Yes: | Claims | 1-18 |
| | No: | Claims | |

2. Citations and explanations
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP99/05632

Re Item I

Basis of the opinion

- 1 Claims 1 and 9 correspond to claims 1, 2 and 9 and pages 4 (lines 25-29), 5 (lines 13-15) and 14 (lines 25-28) of the disclosure as filed.

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

- 1 Citations:

D1: EP-A-0 491 668 (ERICSSON GE MOBILE COMMUNICAT) 24 June 1992
(1992-06-24)

D2: WO 95 22209 A (PETERSEN BRENT ROBERT ;ELEFThERIOU
EVANGELOS (CH); IBM DEUTSCHLAND) 17 August 1995 (1995-08-17)

- 2 The application belongs to the field of digital radio receivers.
- 3 Claims 1 and 9 are regarded as novel and inventive for the following reasoning:

Signals coming from a plurality of users are received by means of many detectors, each one detects one signal from a particular user, relatively to one particular multipath delay. A user whose signals are received relatively weakly is assigned a different number of detectors than a user whose signals are received relatively strongly. This combination of features is not hinted at in the documents D1 and D2.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP99/05632

Re Item VIII

Certain observations on the international application

- 1 The language of claim 1, lines 34-36 is not clear (this refers in particular to the structure of the sentence). It seems that claim 1 could be made clear by expressing the characterizing part according to the corresponding wording of claim 9 (last 4 lines).
- 2 It seems that claim 10, line 3 should read "than to a user".

by each of the rake fingers and serves to effect an iterative process from which data from each of the individual users is recovered by treating the detected symbols as either wanted data which is therefore recovered by the iterative process or
5 interfering symbols which are arranged to be cancelled from the wanted data.

Rake receivers for code division multiple access radio signals suffer from multiple access interference, which is
10 generated from other unwanted radio signals and may be described for the detection of each symbol individually by a cross-correlation between radio signals for different users during one symbol period before a symbol estimate is generated by each of the rake fingers. Furthermore
15 interference is also caused in each of the rake fingers from radio signals reaching the receiver via other paths from the same user which have different temporal displacements which do not correspond with the temporal positions at which each rake finger is recovering the data from the radio signals. As
20 such, self inter symbol interference is caused which may be described for the detection of each symbol individually by the auto-correlation of the radio signals for a specific user with a time shift equal to the difference in the temporal displacement between that operated by the rake finger and
25 other interfering paths during one symbol period before the rake finger recovers an estimate of the symbol.

It is an object of the present invention to provide an improved rake receiver which is arranged to substantially
30 reduce the effects of self inter symbol interference and multiple access interference, to improve a probability of correctly estimating the data symbols.

The invention resides generally in a rake receiver having a
35 plurality of data detectors each of which is arranged to recover data symbols from radio signals at a particular temporal displacement and for a particular user specific code

Claims:

1. A receiver for recovering data for at least one of a plurality of users from contemporaneously detected like modulated radio signals generated by said users from user data in combination with a plurality of user specific codes, said receiver comprising
- a plurality of data detector means (24, 24') each of which is operatively associated with one of the plurality of the user specific codes and one of a plurality temporal displacements with respect to an impulse response of a communications channel through which the radio signals have passed, each of said data detector means (24, 24') operating to estimate symbols of said data for one of said users from said received radio signals in combination with said user specific spreading code and said temporal displacement,
 - a signal strength estimation means (26) which operates to determine a relative strength of the received radio signals from which each of said user data symbols was estimated by said data detectors, and
 - a receiver controller (30) which operates to assign said user codes and said temporal displacements to each of said data detectors (24, 24'), wherein said receiver controller (30) operates to re-assign said plurality of spreading codes and said temporal displacements to said data detectors (24, 24') consequent upon said relative strength of said radio signals, thereby facilitating recovery of data symbols for said at least one user.
2. A receiver as claimed in Claim 1, wherein said receiver controller (30) operates to assign said user specific codes to said plurality of data detectors (24, 24') to the effect that more of said data detectors (24, 24') are assigned the same user specific spreading code and different temporal displacements for a user having a relatively weak signal strength.

3. A receiver as claimed in Claim 1, and further comprising a signal re-generator means (32) coupled to said data detector means (24, 24') which operates to re-generate said received signals associated with at least one user, by
5 combining said estimated user data symbols with said one of said plurality of user specific codes in dependence upon one of said temporal displacements, wherein said data detectors (24, 24') further include means (38) for subtracting said regenerated signals from said received signals, prior to
10 estimation of said user data symbols.

4. A receiver as claimed in any preceding claim and further including a combiner means (28) coupled to said plurality of data detector means (24, 24') and arranged to combine said
15 estimated symbols associated with the same user to form composite symbol decisions to recover the data for the user.

5. A receiver as claimed in Claim 4, wherein said combiner means (28) is a joint detector means which operates to cancel
20 contemporaneously detected data symbols from said composite symbol decision to recover the data associated with one user.

6. A receiver as claimed in any preceding claim, and further including
25 - a data store (22) which serves to store said radio signals received within a pre-determined time window, which stored radio signals are iteratively fed to said data detectors (24, 24') under control of said receiver controller (30).

30 7. A receiver as claimed in any preceding claim, wherein the data detector means are rake fingers (24, 24'), the user specific codes being spreading codes, the radio signals from the plurality of users being generated in accordance with code division multiple access.

35 8. A receiver as claimed in any preceding claim, wherein said signal strength estimator means (26) further operates to

estimate the strength of components of said radio signals received at said temporal displacements, and said receiver controller (30) further operates to re-assign said plurality of data detectors in accordance with said relative strength of said signal components.

9. A method of recovering data for at least one of a plurality of users from contemporaneously detected like modulated radio signals generated from user data and a plurality of user specific codes, said method comprising the steps of;

- processing said radio signals with a plurality of data detector means so as to estimate data symbols associated with a plurality of said users at a plurality of temporal displacements with respect to an impulse response of a communications channel through which said received signals have passed;
- determining a relative strength of the radio signals from which each of said user data symbols were estimated; and
- re-assigning user specific codes and temporal displacements to said plurality of data detectors for at least one of said users in dependence upon the relative signal strengths of said radio signals.

10. A method as claimed in Claim 9, and further including the steps of;

- storing said radio signals received within a pre-determined temporal window; and
- re-estimating said user data symbols for said re-assigned codes and temporal displacements from said stored radio signals, thereby providing an improved estimate of said user data symbols.

11. A method as claimed in Claim 10, and further including the step of

- further re-assigning said user specific codes and said temporal displacements in dependence upon said relative

signals strengths and further re-estimating said user data symbols from said stored received radio signals, further detecting said user data symbols.

- 5 12. A method as claimed in Claim 9, and further including the step of;
- storing said radio signals received within a pre-determined temporal window;
 - re-generating some of said radio signals from said
 - 10 estimated user data symbols and said user specific spreading codes for at least one temporal displacement;
 - subtracting said re-generated radio signals from said stored radio signals;
 - for user data symbols not so far detected, re-assigning to
 - 15 said data detectors the user specific codes of said not so far detected users and a plurality of said temporal displacements; and
 - estimating said not so far detected user data symbols using said data detectors.

20

13. A method as claimed in Claim 12, and further including the steps of;
- repeating the steps of regenerating radio signals for said detected user data symbols and subtracting the regenerated
 - 25 radio signals from the stored radio signals;
 - further re-assigning to said data detectors the user specific codes of said not so far detected users and a plurality of said temporal displacements; and
 - further estimating said not so far detected user data
 - 30 symbols.

14. A method as claimed in Claim 13, and further including the step of
- repeating the steps of claim 13 until the data symbols from
 - 35 all users have been detected.

15. A method as claimed in any of claims 10 to 14, and further including the steps of

- determining the relative strengths of components of said received signals at each of said plurality of temporal
5 displacements; and

- assigning said temporal displacements to said plurality of data detectors in dependence upon the relative strength of said signal components.

10 16. A method as claimed in any of Claims 9 to 15, and further including the step of

- combining each of the user data symbols associated with particular users to form composite output symbols.

15 17. A method as claimed in Claim 16, and further including the step of

- joint detecting the effects of the data symbols from other users and cancelling said effects from said composite output signal.

20 18. A method as claimed any of claims 9 to 17, wherein said user specific codes are spreading codes, said radio signals being combined with said data in accordance with code division multiple access.

25 19. A receiver as herein before described with reference to the accompanying drawings.

by each of the rake fingers and serves to effect an iterative process from which data from each of the individual users is recovered by treating the detected symbols as either wanted data which is therefore recovered by the iterative process or
5 interfering symbols which are arranged to be cancelled from the wanted data.

Rake receivers for code division multiple access radio signals suffer from multiple access interference, which is
10 generated from other unwanted radio signals and may be described for the detection of each symbol individually by a cross-correlation between radio signals for different users during one symbol period before a symbol estimate is generated by each of the rake fingers. Furthermore
15 interference is also caused in each of the rake fingers from radio signals reaching the receiver via other paths from the same user which have different temporal displacements which do not correspond with the temporal positions at which each rake finger is recovering the data from the radio signals. As
20 such, self inter symbol interference is caused which may be described for the detection of each symbol individually by the auto-correlation of the radio signals for a specific user with a time shift equal to the difference in the temporal displacement between that operated by the rake finger and
25 other interfering paths during one symbol period before the rake finger recovers an estimate of the symbol.

In EP 0 491 668 A and WO 95/22209 CDMA demodulators are described which decode the received composite signal in the
30 order of strongest to weakest signal strength. The number of decoder elements or data detectors is the same for every user spreading code.

It is an object of the present invention to provide an
35 improved rake receiver which is arranged to substantially

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reduce the effects of self inter symbol interference and multiple access interference, to improve a probability of correctly estimating the data symbols.

- 5 The invention resides generally in a rake receiver having a plurality of data detectors each of which is arranged to recover data symbols from radio signals at a particular temporal displacement and for a particular user specific code

Claims:

1. A receiver for recovering data for at least one of a plurality of users from contemporaneously detected like modulated radio signals generated by said users from user data in combination with a plurality of user specific codes, said receiver comprising
- a plurality of data detector means (24, 24') each of which is operatively associated with one of the plurality of the user specific codes and one of a plurality temporal displacements with respect to an impulse response of a communications channel through which the radio signals have passed, each of said data detector means (24, 24') operating to estimate symbols of said data for one of said users from said received radio signals in combination with said user specific spreading code and said temporal displacement,
 - a signal strength estimation means (26) which operates to determine a relative strength of the received radio signals from which each of said user data symbols was estimated by said data detectors, and
 - a receiver controller (30) which operates to assign said user codes and said temporal displacements to each of said data detectors (24, 24'), wherein said receiver controller (30) operates to re-assign said plurality of spreading codes and said temporal displacements to said data detectors (24, 24') consequent upon said relative strength of said radio signals, thereby facilitating recovery of data symbols for said at least one user.
- characterised in
- said receiver controller (30) operates to assign said user specific codes to said plurality of data detectors (24, 24') to the effect that a different number of said data detectors (24, 24') are assigned the same user specific spreading code and different temporal displacements for a user having a relatively weak signal strength than for a user having a relatively strong signal strength.

2. A receiver as claimed in Claim 1, wherein said receiver controller (30) operates to assign said user specific codes to said plurality of data detectors (24, 24') to the effect that more of said data detectors (24, 24') are assigned the same user specific spreading code and different temporal displacements for a user having a relatively weak signal strength than for a user having a relatively strong signal strength.
3. A receiver as claimed in Claim 1, wherein said receiver controller (30) operates to assign said user specific codes to said plurality of data detectors (24, 24') to the effect that more of said data detectors (24, 24') are assigned the same user specific spreading code and different temporal displacements for a user having a relatively strong signal strength than for a user having a relatively weak signal strength.
4. A receiver as claimed in Claim 1, and further comprising a signal re-generator means (32) coupled to said data detector means (24, 24') which operates to re-generate said received signals associated with at least one user, by combining said estimated user data symbols with said one of said plurality of user specific codes in dependence upon one of said temporal displacements, wherein said data detectors (24, 24') further include means (38) for subtracting said regenerated signals from said received signals, prior to estimation of said user data symbols.
5. A receiver as claimed in any preceding claim and further including a combiner means (28) coupled to said plurality of data detector means (24, 24') and arranged to combine said estimated symbols associated with the same user to form composite symbol decisions to recover the data for the user.
6. A receiver as claimed in any preceding claim, and further including

- a data store (22) which serves to store said radio signals received within a pre-determined time window, which stored radio signals are iteratively fed to said data detectors (24, 24') under control of said receiver controller (30).

5

7. A receiver as claimed in any preceding claim, wherein the data detector means are rake fingers (24, 24'), the user specific codes being spreading codes, the radio signals from the plurality of users being generated in accordance with code division multiple access.

10

8. A receiver as claimed in any preceding claim, wherein said signal strength estimator means (26) further operates to estimate the strength of components of said radio signals received at said temporal displacements, and said receiver controller (30) further operates to re-assign said plurality of data detectors in accordance with said relative strength of said signal components.

15

9. A method of recovering data for at least one of a plurality of users from contemporaneously detected like modulated radio signals generated from user data and a plurality of user specific codes, said method comprising the steps of;

20

- processing said radio signals with a plurality of data detector means so as to estimate data symbols associated with a plurality of said users at a plurality of temporal displacements with respect to an impulse response of a communications channel through which said received signals have passed;

25

30

- determining a relative strength of the radio signals from which each of said user data symbols were estimated; and
- re-assigning user specific codes and temporal displacements to said plurality of data detectors for at least one of said users in dependence upon the relative signal strengths of said radio signals characterised in

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that the re-assignment is carried out in such a way that a user with signals having a relatively weak signal strength is assigned a different number of said detectors than a user with signals having a relatively strong signal strength.

5

10. A method as claimed in Claim 9, characterised in assigning more detectors to an user with signals having a relatively weak signal strength than a user with signals having a relatively strong signal strength.

10

11. A method as claimed in Claim 9, characterised in assigning more detectors to an user with signals having a relatively strong signal strength than a user with signals having a relatively weak signal strength.

15

12. A method as claimed in any of Claims 9 to 11, and further including the steps of;

- storing said radio signals received within a pre-determined temporal window; and

20

- re-estimating said user data symbols for said re-assigned codes and temporal displacements from said stored radio signals, thereby providing an improved estimate of said user data symbols.

25

13. A method as claimed in Claim 12, and further including the step of

- further re-assigning said user specific codes and said temporal displacements in dependence upon said relative signals strengths and further re-estimating said user data symbols from said stored received radio signals, further detecting said user data symbols.

30

14. A method as claimed in any of Claims 9 to 11, and further including the step of;

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- storing said radio signals received within a pre-determined temporal window;

22

- re-generating some of said radio signals from said estimated user data symbols and said user specific spreading codes for at least one temporal displacement;
- subtracting said re-generated radio signals from said
5 stored radio signals;
- for user data symbols not so far detected, re-assigning to said data detectors the user specific codes of said not so far detected users and a plurality of said temporal displacements; and
- 10 - estimating said not so far detected user data symbols using said data detectors.

15. A method as claimed in Claim 14, and further including the steps of;

- 15 - repeating the steps of regenerating radio signals for said detected user data symbols and subtracting the regenerated radio signals from the stored radio signals;
- further re-assigning to said data detectors the user specific codes of said not so far detected users and a
20 plurality of said temporal displacements; and
- further estimating said not so far detected user data symbols.

16. A method as claimed in Claim 15, and further including
25 the step of

- repeating the steps of claim 15 until the data symbols from all users have been detected.

17. A method as claimed in any of claims 12 to 16, and
30 further including the steps of

- determining the relative strengths of components of said received signals at each of said plurality of temporal displacements; and
- assigning said temporal displacements to said plurality of
35 data detectors in dependence upon the relative strength of said signal components.

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18. A method as claimed in any of claims 9 to 17, wherein said user specific codes are spreading codes, said radio signals being combined with said data in accordance with code division multiple access.

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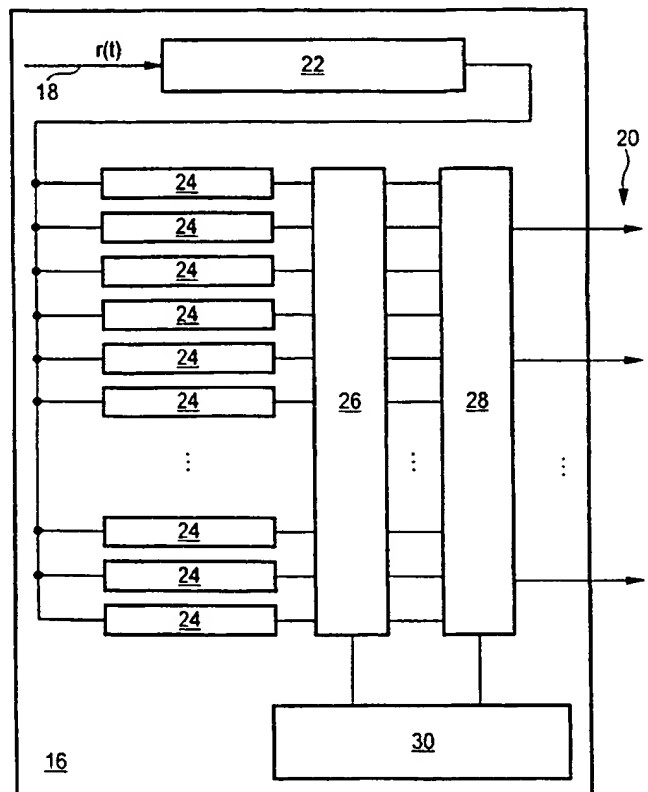
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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|---|-----------|---|
| (51) International Patent Classification ⁷ : H04B 1/707 | A1 | (11) International Publication Number: WO 00/13334 (43) International Publication Date: 9 March 2000 (09.03.00) |
| (21) International Application Number: PCT/EP99/05632 (22) International Filing Date: 3 August 1999 (03.08.99) (30) Priority Data: 98116318.1 28 August 1998 (28.08.98) EP (71) Applicant (for all designated States except US): SIEMENS AKTIENGESELLSCHAFT [DE/DE]; Wittelsbacherplatz 2, D-80333 München (DE). (72) Inventor; and (75) Inventor/Applicant (for US only): RADEMACHER, Leo [DE/DE]; Haidstrasse 7e, D-83607 Holzkirchen (DE). (74) Common Representative: SIEMENS AKTIENGESELLSCHAFT; Postfach 22 16 34, D-80506 München (DE). | | (81) Designated States: JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> |

(54) Title: RECEIVER AND METHOD OF RECOVERING DATA FROM RADIO SIGNALS

(57) Abstract

A receiver for recovering data for at least one of a plurality of users comprising, a plurality of data detector means (24, 24') coupled to the data store (22), each of which data detector means (24, 24') is operatively associated with one of a plurality of the user specific codes and one of a plurality temporal displacements with respect to an impulse response of a communications channel through which the radio signals have passed, each of the data detector means (24, 24') operating to estimate symbols of the data for one of the users from the received radio signals in combination with the user specific spreading code and the temporal displacement, a signal strength estimation means (26) which operates to determine a relative strength of the received radio signals from which each of the user data symbols was estimated by the data detectors, and a receiver controller (30) which operates to assign the user codes and the temporal displacements to each of the data detectors (24, 24'), wherein the receiver controller (30) operates to re-assign the plurality of spreading codes and the temporal displacements to said data detectors (24, 24') consequent upon the relative strength of the radio signals, thereby facilitating recovery of data symbols for the at least one user.



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FIG 1

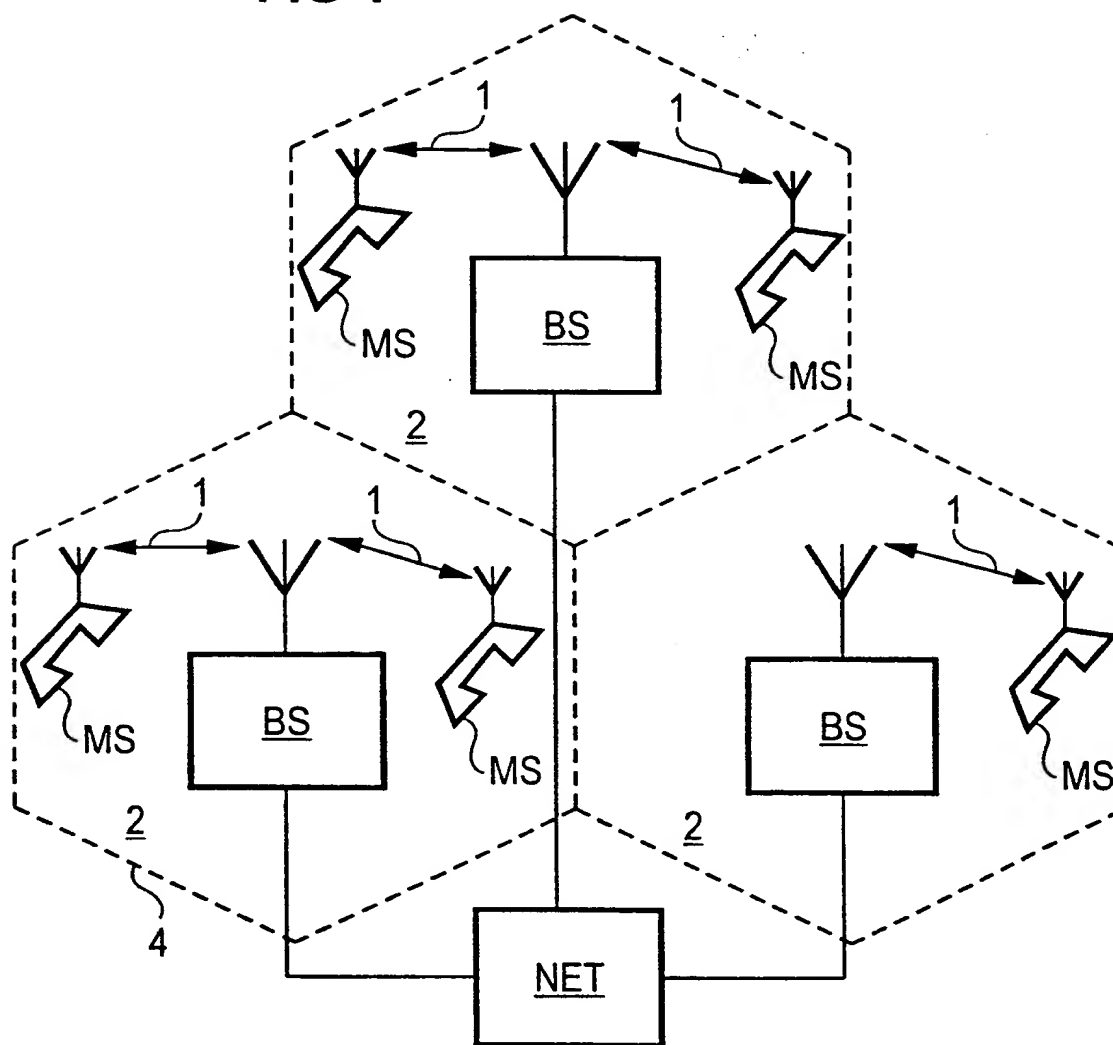
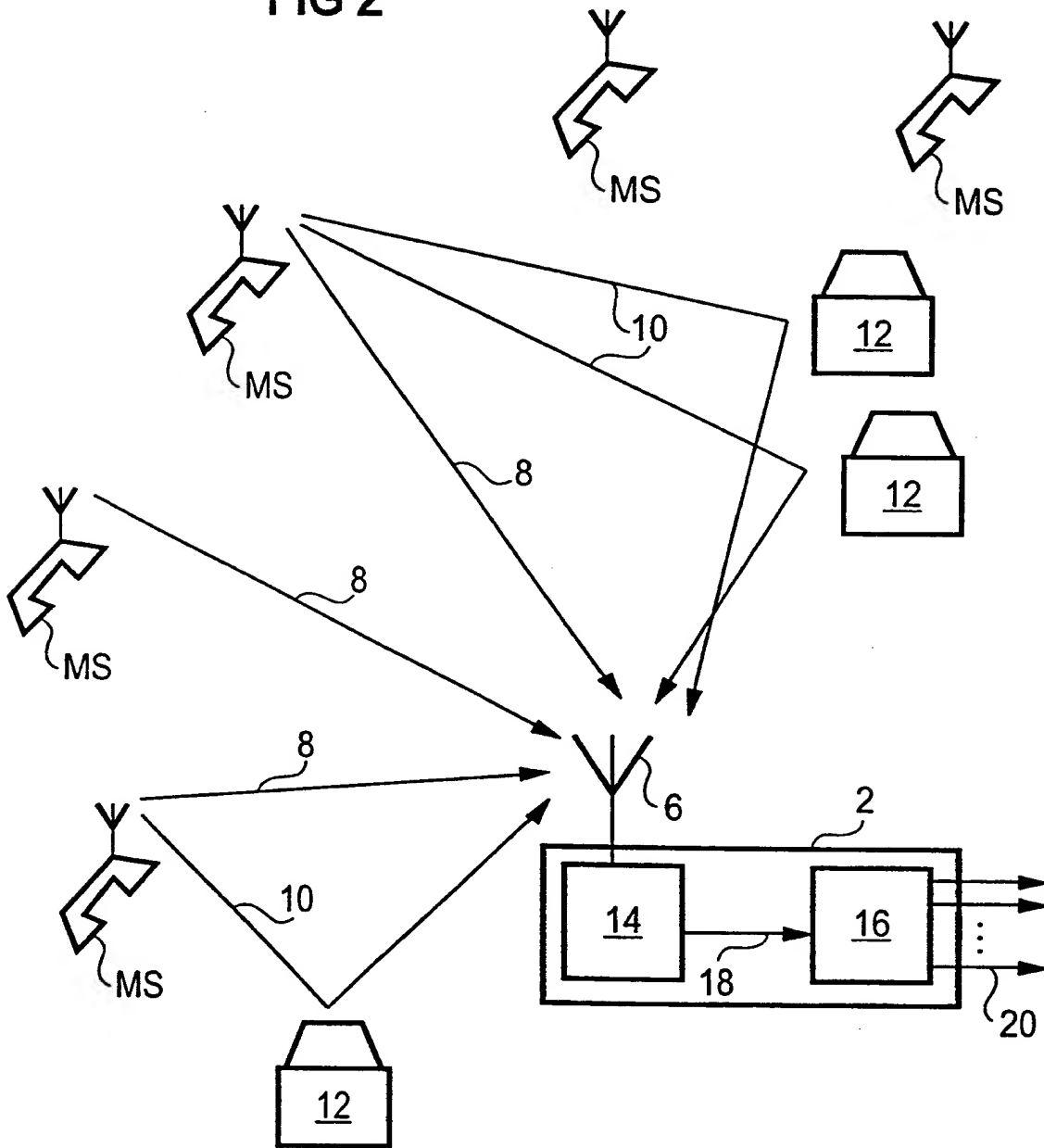


FIG 2



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FIG 3

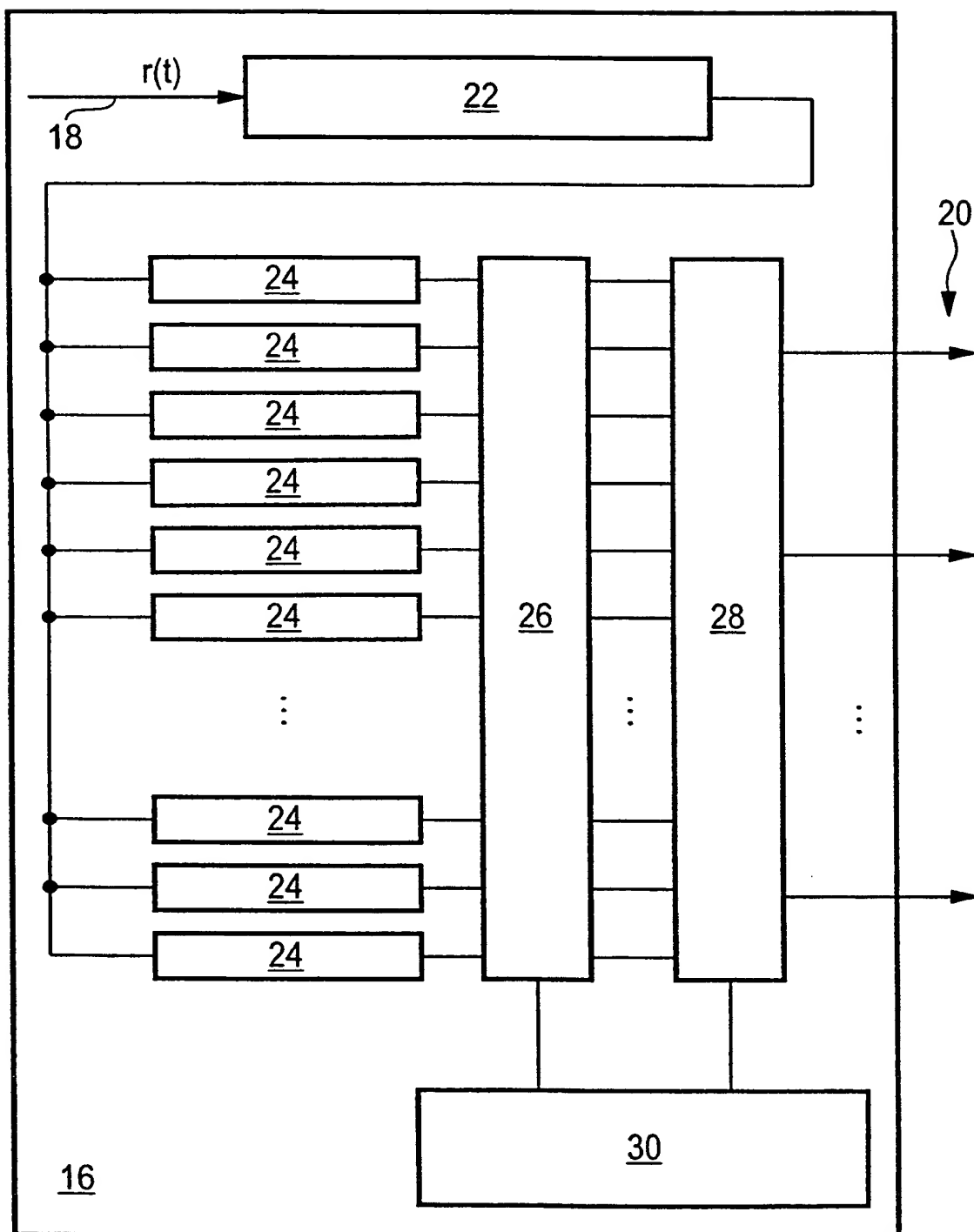
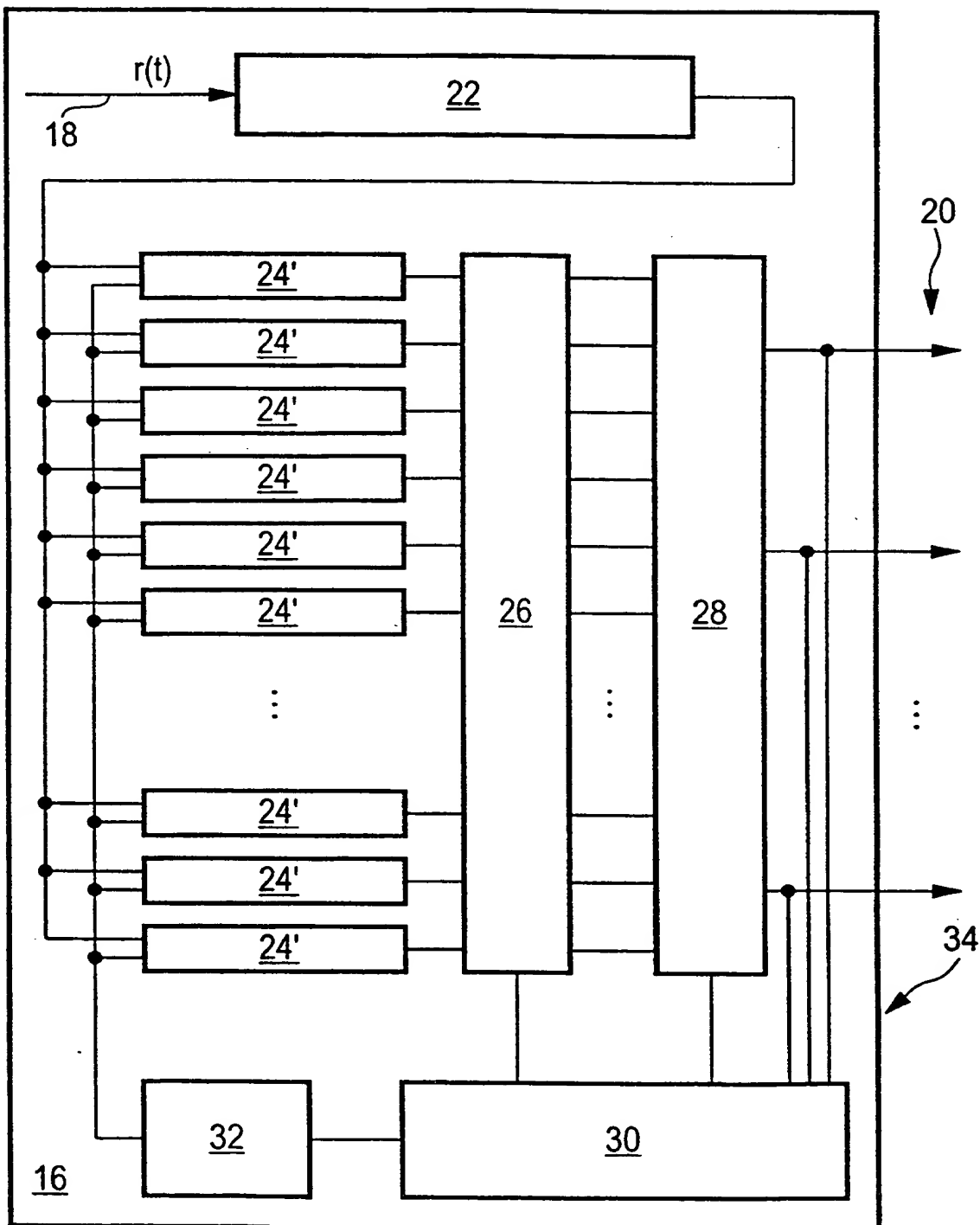
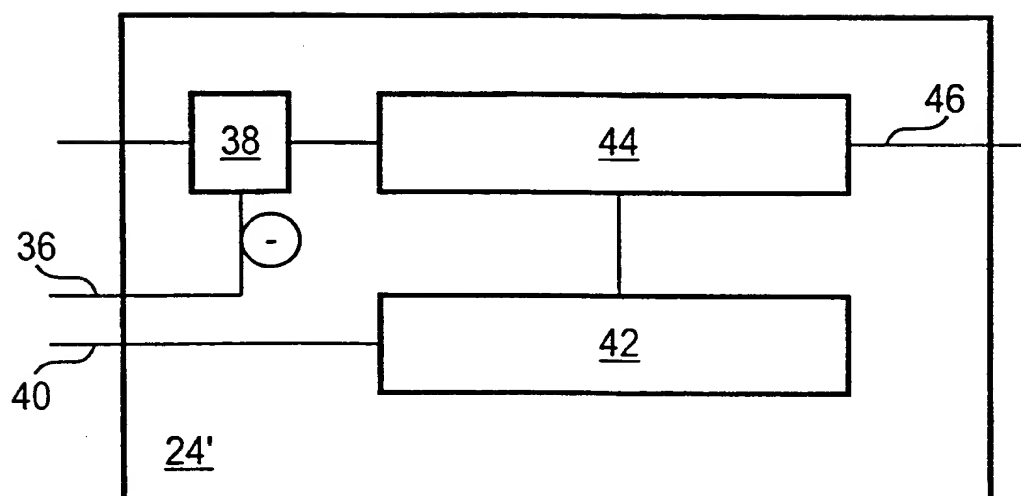


FIG 4



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FIG 5



INTERNATIONAL SEARCH REPORT

Intern Application No

PCT/EP 99/05632

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B1/707

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------|
| X | <p>EP 0 491 668 A (ERICSSON GE MOBILE COMMUNICAT) 24 June 1992 (1992-06-24)</p> <p>abstract</p> <p>column 2, line 52 -column 3, line 41</p> <p>column 4, line 55 -column 5, line 15;</p> <p>figure 3</p> <p>column 6, line 44 -column 7, line 9</p> <p>column 7, line 51 -column 8, line 2;</p> <p>figure 7</p> <p>column 8, line 57 -column 9, line 11;</p> <p>figure 8</p> <p>column 9, line 27 - line 43</p> <p>column 10, line 10 - line 49</p> <p>column 12, line 28 - line 35</p> <p>column 18, line 1 - line 12</p> <p style="text-align: center;">---</p> <p style="text-align: center;">-/--</p> | 1-19 |

☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

16 December 1999

Date of mailing of the international search report

12/01/2000

Name and mailing address of the ISA

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|------------------------|
| X | WO 95 22209 A (PETERSEN BRENT ROBERT ;ELEFTHERIOU EVANGELOS (CH); IBM DEUTSCHLAND) 17 August 1995 (1995-08-17) | 1,2, 9-11,18, 19 |
| A | page 5, line 17 -page 6, line 15 | 3-8, 12-17 |
| A | US 5 490 165 A (WEAVER JR LINDSAY A ET AL) 6 February 1996 (1996-02-06) column 5, line 45 -column 6, line 56; figures 1,6 | 1,9 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 99/05632

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
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| | | ZA 9407841 A | 18-05-1995 |

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GR 98P2423

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/EP 99/05632

International filing date

(day/month/year)

03/08/1999

Applicant

SIEMENS AKTIENGESELLSCHAFT et al.

- 1.
- ☒
- The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.**Where?** Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35**For more detailed instructions,** see the notes on the accompanying sheet.

- 2.
- ☐
- The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

- 3.
- ☐
- With regard to the protest**
- against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

- 4.
- Further action(s):**
- The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority

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Fax: (+31-70) 340-3016

Authorized officer

Liliane Van Velzen-Peron

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| | | |
|--|---|--|
| Applicant's or agent's file reference GR 98P2423 | FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. | |
| International application No. PCT/EP 99/ 05632 | International filing date (day/month/year) 03/08/1999 | (Earliest) Priority Date (day/month/year) 28/08/1998 |
| Applicant SIEMENS AKTIENGESELLSCHAFT et al. | | |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

3



None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 99/05632

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04B1/707

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
| X | EP 0 491 668 A (ERICSSON GE MOBILE COMMUNICAT) 24 June 1992 (1992-06-24) abstract column 2, line 52 -column 3, line 41 column 4, line 55 -column 5, line 15; figure 3 column 6, line 44 -column 7, line 9 column 7, line 51 -column 8, line 2; figure 7 column 8, line 57 -column 9, line 11; figure 8 column 9, line 27 - line 43 column 10, line 10 - line 49 column 12, line 28 - line 35 column 18, line 1 - line 12 --- -/-- | 1-19 |



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

16 December 1999

Date of mailing of the international search report

12/01/2000

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 99/05632

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------------|--|--|
| X A A | WO 95 22209 A (PETERSEN BRENT ROBERT ;ELEFThERIOU EVANGELOS (CH); IBM DEUTSCHLAND) 17 August 1995 (1995-08-17) page 5, line 17 -page 6, line 15 ----- US 5 490 165 A (WEAVER JR LINDSAY A ET AL) 6 February 1996 (1996-02-06) column 5, line 45 -column 6, line 56; figures 1,6 ----- | 1,2, 9-11,18, 19 3-8, 12-17 1,9 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 99/05632

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
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| | | DE 69412288 T | 22-04-1999 |
| | | EP 0744101 A | 27-11-1996 |
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| | | ZA 9407841 A | 18-05-1995 |

INTERNATIONAL SEARCH REPORT

Intern Application No

PCT/EP 99/05632

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04B1/707

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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|------------|---|-----------------------|
| X | <p>EP 0 491 668 A (ERICSSON GE MOBILE COMMUNICAT) 24 June 1992 (1992-06-24)</p> <p>abstract</p> <p>column 2, line 52 -column 3, line 41</p> <p>column 4, line 55 -column 5, line 15;</p> <p>figure 3</p> <p>column 6, line 44 -column 7, line 9</p> <p>column 7, line 51 -column 8, line 2;</p> <p>figure 7</p> <p>column 8, line 57 -column 9, line 11;</p> <p>figure 8</p> <p>column 9, line 27 - line 43</p> <p>column 10, line 10 - line 49</p> <p>column 12, line 28 - line 35</p> <p>column 18, line 1 - line 12</p> <p style="text-align: center;">---</p> <p style="text-align: center;">-/--</p> | 1-19 |

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"&" document member of the same patent family

Date of the actual completion of the international search

16 December 1999

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12/01/2000

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 99/05632

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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| A | page 5, line 17 -page 6, line 15 ----- | 3-8, 12-17 |
| A | US 5 490 165 A (WEAVER JR LINDSAY A ET AL) 6 February 1996 (1996-02-06) column 5, line 45 -column 6, line 56; figures 1,6 ----- | 1,9 |

INTERNATIONAL SEARCH REPORT

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International Application No

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| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
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